The present invention, by contrast, does not take a two step LS/LMS approach to obtaining a more efficient MLSE algorithm for obtaining a branch metric. The LS portion of Namekata calculates channel estimates. The present invention assumes that channel estimates have already been obtained and focuses its efforts on more efficient MLSE operation once channel estimates have been obtained. In other words, Namekata's efforts in the LS portion have no equivalent counterpart in the present invention. Moreover, citations to Namekata that reference the LS portion of their approach do not read on or anticipate steps that occur in the present invention.

The Examiner has cited cols. 9-10 and Eq. 7 of Namekata as reading on the present invention's step of "pre-computing values equal to a product of a complex number and a hypothesized symbol value". However, these cited portions describe the process of creating the G matrix which is clearly part of the LS step for obtaining channel estimates in a non-recursive manner. This is admitted by Namekata in col. 8, lns. 62-65 that state, "A G matrix of the LS algorithm during the known signal sequence period as a means for reducing the calculation amount according to the second arrangement will be briefly described below." Moreover, the Examiner has applied the same cited portions of Namekata to the present invention's storing and adding steps. Again these passages refer to Namekata's LS processing step(s) that are intended to provide initial channel estimates to be input into the MLSE. To reiterate, the present invention employs no such LS processing steps or function or any equivalent thereof.

Namekata uses an LS approach to create its G matrix then uses the G matrix in a second LMS arrangement as a means for reducing the amount of calculation for the MLSE. This is separate and distinct from the approach taken by the present invention. The present invention seeks to reduce the number of multiplications performed by the MLSE by pre-computing certain and storing

values needed for the determination of the branch metric. When a branch metric computation is to be made, certain multiplication operations are replaced by simple table look-up operations resulting in reduced power consumption and overall size of the equalizer.

Namekata differs from the present invention in that Namekata does not create, maintain, nor use a product lookup table of multiplication values that have been pre-computed. Namekata's G-matrix is not the same as nor an equivalent of the product lookup table recited and claimed in the present invention.

Applicant respectfully requests reconsideration and withdrawal of the 35 USC 102(b) rejection of claims 1-5, 9, and 13 based on Namekata.

The Examiner has also rejected claims 1, 2, 4, 5, 6, 7, 9, 10, 12 and 13 under 35 USC 103(a) based on U.S. Pat. No. 5,949,796 to Kumar.

The present invention is based in an RF receiver wherein the MLSE is applied to the equalization portion of the receiver as opposed to an MLSE decoding procedure. Equalization and decoding are very distinct and different from one another. Procedures or steps used for equalization do not necessarily apply to MLSE decoding since the information signal being operated on for equalization and decoding are different.

In previous office actions, the Examiner has stated that, "[A]pplicant's assertions that branch metrics in Kumar are not applied to a receiver and an MLSE equalizer are incorrect." This is a clear misinterpretation of Kumar on the part of the Examiner. The Examiner cited col. 33,lines 24-30 and Figures 9 and 14a to rebut applicant's assertions. In doing so, however, the Examiner has mis-characterized the Kumar reference.

One of the misunderstandings is the difference between MLSE equalization (used to handle distortion introduced by the radio channel) and

MLSE decoding (used to decode a forward error correcting code applied at the transmitter). Kumar, col. 33, lines 24-30 clearly refers to the need to "decode" in the context of convolutional codes. Thus, the "sequence" that Kumar is estimating is the information bit sequence, using the equalized received symbols. By contrast, the present invention estimates the "sequence" of transmitted symbols, performing the equalization process. The claims of the present invention clearly indicate that the context of the present invention is an equalizer.

Regarding Figures 9 and 14A, Figure 9 clearly shows an equalizer (209). The actions of deinterleaving and bit estimation occur **after** equalization. Thus, the Viterbi decoder in Figure 14A, which occurs **after** bit estimation and deinterleaving, is **not** the equalizer, but rather the convolutional decoder. Therefore, the branch metrics discussed in Kumar do **not** apply to the equalizer as asserted by the Examiner. There is no MLSE equalization in Kumar, just MLSE decoding which is an entirely different procedure.

The Examiner has previously referred to Fig. 9 and filters 204 and 209. Filter 204 is an analog filter used in the process of converting the RF signal to baseband. Filter 209 is the equalizer, used to demodulate the symbols transmitted. In col. 58 of Kumar, this equalizer is described as compensating for the RF propagation channel (an equalizer, not a decoder). It is a FIR or IIR filter with adaptive filter taps. A decision feedback equalizer may also be. Starting at col. 58, line 40, Kumar indicates that channel estimation may be performed as part of equalization yet no details are given. Applicant, in his expertise, interprets this as performing channel estimates, then determining equalizer weights from those for linear or DFE equalization. Both linear and DFE are filtering approaches, in that they filter the received signal to produce bit estimates. DFE includes a feedback filter, which filters previous symbol decisions as well.

It is true that filtering involves convolving the signal with a set of coefficients. It is also true that an adaptive equalizer starts with an initial set of

coefficients. However, these coefficients are filter weights, **not** hypothesized symbols. With linear equalization (Kumar), there is no consideration given to different hypothesized symbol values. The filter output is used to produce a single detected symbol value. A linear equalizer does not "precompute" an output, it "computes" an output. It also updates the equalizer weights. In the present invention, precompute means more than compute. Precompute means computing a quantity, storing it, and using it multiple times to form branch metrics efficiently. This is different from Kumar's computing equalizer weights, storing them, and using them multiple times to form symbol estimates.

Yet another mischaracterization of the Kumar reference involves mixing operations that occur in the transmitter portion of a system and the receiver portion of a system. The present invention only describes operations in an equalizer in a receiver. The Examiner, however, has cited a part of Kumar that describes operations in a modulator in a transmitter. Specifically, Kumar col. 43, lns. 43-45 refers to an IFFT, which is part of signal generators 47 and 49. These appear in Figure 4, which is clearly a transmitter, as it starts with a source message and ends with a power amplifier and transmit antenna. In col. 32, the description of drawings indicates that Fig. 4 is "an IBOC DAB transmitter." As Fig. 9 is an "IBOC DAB receiver" and block 209 of Fig. 9 is an equalizer, it is clear that equalization is performed at the receiver, not the transmitter.

In addition, convolution (filtering) does not necessarily imply a "look-up" table. The fact that memory is needed to store intermediate results does not mean that those intermediate results will be used again in another computation.

Due to Applicant's belief that the Kumar reference has been mis-characterized by the Examiner, Applicants respectfully request reconsideration and withdrawal of the 35 USC 103(a) rejections of claims 1-2, 4-7, 9-10, and 12-13 based on the Kumar reference. Similarly, Applicants further request

reconsideration and withdrawal of the 35 USC 103(a) rejections of claims 3, 8, and 11 in which Kumar is cited as the primary reference in the rejection.

CONCLUSION

For the reasons set forth above, the applicants believe the claims of the present application are in condition for allowance, which action is respectfully requested.

However, if the applicants have failed to adequately respond to any of the Examiner's objections or requirements or if the Examiner intends to finally reject the application, the applicants invite the Examiner's telephone communication of that fact to the applicants' attorney, Mr. Gregory Stephens at 919-286-8000 so that an interview can be arranged to resolve any discrepancy.

Respectfully submitted,
For the applicants,

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